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TITLE: TELEMATICS BASED PROGRAMMING GATEWAY

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# TELEMATICS BASED PROGRAMMING GATEWAY

## FIELD OF THE INVENTION

The invention relates to vehicle design and manufacture, and more particularly to methods and systems for interactive vehicle design through the operation of a mobile of wireless communication enabled test vehicles within a wireless communication network.

## BACKGROUND OF THE INVENTION

Presently, many passenger vehicles, buses, trucks and the like, incorporate complex component vehicle systems. The application of very large scale integration components (VLSI) for processing and control functions permit the use of discrete computer controlled sub-systems within a vehicle to control many vital vehicle functions. Furthermore, many vehicles incorporate a vehicle system communication bus to permits bi-directional communication between the component systems of such a vehicle. One example of a computer controlled vehicle system is a power-train control module (PCM). The power-train control module for a vehicle typically controls combustion, engine timing and fuel mixture among other functions. Generally, each type of vehicle system control module incorporates application-specific software that executes various system functions and also operating parameters for the vehicle system. Each vehicle manufacturer integrates different functions into vehicle system modules. However, as each successive generation of control devices becomes more sophisticated the necessity for periodic in-field system service dramatically increases.

At present, in order to provide field service to various vehicle system modules, a vehicle must be brought to a qualified vehicle service facility and plugged into a specialized computing system to download software updates and new system parameters. However, the distribution of software updates, dedicated download computer systems and field technician training is expensive and requires an extensive infrastructure. Furthermore, a time-sensitive or system–critical update may be delayed if a customer is unaware of a system malfunction and the efficacy of the present field service regimen is suspect. The cost of dealership services, particularly for vehicles under warranty, must be absorbed into the cost of the vehicle to a consumer.

Many passenger vehicles now incorporate an integrated communication system. A Vehicle Communication Unit (VCU) used in conjunction with a Wide Area Network (WAN) such as a cellular telephone network or a satellite communication system allows for a variety of fee-based subscription services to be provided in a mobile environment. The VCU is typically a vehicle telematics device including a cellular radio, satellite transceiver and/or global positioning capabilities. Communication through a carrier service may be initiated at the VCU at turn-on or through manual or voice command phone number entry. Typically, a radio communication link is established between the VCU and a Wide Area Network (WAN), using a node of the WAN in the vicinity of the VCU.

In addition to enabling telecommunication services, a VCU may be configured to receive various types of data from a service provider. In some implementations, a VCU is also configured to provide various vehicle system information data to the service provider from the vehicle such as through a so-called vehicle data upload (VDU) operation. Such vehicle system information typically includes data such as service codes and error codes, for example.

It would be desirable therefore, to provide field service software updates to a mobile vehicle having a telematics device that overcomes these and other disadvantages.

SUMMARY OF THE INVENTION

The present invention is directed to a method of providing field service software updates to a mobile vehicle having a telematics device. The method describes initiating a vehicle field service software update, sending field service software update data to a vehicle telematics device from a telematics service center, receiving the field service software update data at the vehicle telematics device and providing the field software update data to at least one vehicle system from the vehicle telematics device wherein the at least one vehicle system is updated based on the field service software update data.

In accordance with yet another aspect of the invention a computer readable medium includes computer readable code for initiating a vehicle field service software update, computer readable code for sending field service software update data to a vehicle telematics device from a telematics service center, computer readable code for storing received field service software update data at the vehicle telematics device, and computer readable code for providing the field software update data to at least one vehicle system from the vehicle telematics device wherein the at least one vehicle system is updated based on the field service software update data.

In accordance with still another aspect of the invention, a system for providing field service software updates to a mobile vehicle includes means for initiating a vehicle field service software update, means for sending field service software update data to a vehicle telematics device from a telematics service center, means for receiving the field service software update data at the vehicle telematics device and means for providing the field software update data to at least one vehicle system from the vehicle telematics device wherein the at least one vehicle system is updated based on the field service software update data.

The foregoing and other features and advantages of the invention will become further apparent from the following detailed description of the presently preferred embodiment, read in conjunction with the accompanying drawings. The detailed description and drawings are merely illustrative of the invention rather than limiting, the scope of the invention being defined by the appended claims and equivalents thereof.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG.1 is an illustrative operating environment for a telematics based programming gateway in an embodiment of the present invention;

FIG. 2 is a block diagram of a telematics based programming gateway in accordance with an embodiment of the present invention;

FIG. 3 is a process flow diagram of a method for providing field service software updates to a mobile vehicle having a telematics device; and

FIG. 4 is a process flow diagram of a method for providing field service software updates to a mobile vehicle having a telematics device in another embodiment of the present invention.

## DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENT

FIG.1 is an illustrative operating environment for a telematics based programming gateway in an embodiment of the present invention. FIG. 1 shows a mobile vehicle communication system **100**. Mobile communication system **100** includes at least one mobile vehicle **110** (vehicle, test vehicle) including vehicle communication bus **112** and vehicle communications unit (VCU) **120**, one or more wireless carrier systems **140**, one or more communication networks **142**, one or more land networks **144**, one or more client, personal or user computers **150**, one or more web-hosting portals **160**, and one or more call centers **170**. In one embodiment, mobile vehicle **110** is implemented as a vehicle equipped with suitable hardware and software for transmitting and receiving voice and data communications.

In one embodiment, vehicle communications unit **120** is a telematics device that includes a digital signal processor (DSP) **122** connected to a wireless modem **124**, a global positioning system (GPS) unit **126**, an in-vehicle memory **128**, such as, for example, a non-volatile flash memory, a microphone **130**, one or more speakers **132**, an embedded or in-vehicle mobile phone **134**, and a wireless access point node **136**. In one embodiment, DSP **122** is a microcontroller, controller, host processor, or vehicle communications processor. In an example, DSP **122** is implemented as an application specific integrated circuit (ASIC). GPS unit **126** provides longitude and latitude coordinates of the vehicle, as well as a time stamp. In-vehicle mobile telephone system **134** is a cellular-type phone, such as, for example an analog, digital, dual-mode, dual-band, multi-mode or multi-band cellular phone. In another example, the mobile telephone system is an analog mobile telephone system operating over a prescribed band nominally at 800 MHz. In another example, the mobile telephone system is a digital mobile telephone system operating over a prescribed band nominally at 800 MHz, 900 MHz, 1900 MHz, or any suitable band capable of carrying digital cellular communications.

DSP **122** executes various computer programs and communication control and protocol algorithms that control communication, programming and operational modes of electronic and mechanical systems within test vehicle **110**. In one embodiment, DSP **122** is an embedded system controller. In another embodiment, DSP **122** controls communications between telematics device **120**, wireless carrier system **140**, and call center **170**. In another embodiment, DSP **122** controls communications between the wireless access point node **134** and nodes of a mobile ad hoc network. In one embodiment, a voice-recognition application is installed in DSP **122** to translate human voice input through microphone **130** into digital signals. DSP **122** generates and accepts digital signals transmitted between telematics device **120** and a vehicle communication bus **112** that is connected to various electronic modules in the vehicle **110**. In

one embodiment, the digital signals activate a programming mode and operation modes, as well as provide for data transfers. In another embodiment, a vehicle data upload (VDU) utility program facilitates the transfer of instructions and data requests to vehicle **110** and field service software update data.

Mobile vehicle **110**, via a vehicle communication bus **112**, sends signals to various units of equipment and systems within test vehicle **110** to perform various functions such as monitoring the operational state of vehicle systems, collecting and storing data from the vehicle systems, providing instructions, data and programs to various vehicle systems and calling from telematics device **120**. In facilitating interactions among the various communication and electronic modules, vehicle communication bus **112** utilizes bus interfaces such as controller-area network (CAN), International Organization for Standardization (ISO) Standard 9141, ISO Standard 11898 for high-speed applications, ISO Standard 11519 for lower speed applications, and Society of Automotive Engineers (SAE) standard J1850 for higher and lower speed applications. In one embodiment, vehicle communication bus **112** is a direct connection between connected devices.

Test vehicle **110**, via telematics device **120**, sends and receives radio transmissions from wireless carrier system **140**. Wireless carrier system **140** is implemented as any suitable system for transmitting a signal from mobile vehicle **110** to communication network **142**. Wireless carrier system **140** incorporates any type of telecommunications in which electromagnetic waves carry signal over part of or the entire communication path. In one embodiment, wireless carrier system **140** transmits analog audio and/or video signals. In an example, wireless carrier system **140** transmits analog audio and/or video signals such as those sent from AM and FM radio stations and transmitters, or digital audio signals in the S band (approved for use in the U.S.) and L band (used in Europe and Canada). In one embodiment, wireless carrier system **140** is a satellite

broadcast system broadcasting over a spectrum in the "S" band (2.3 GHz) that has been allocated by the U.S. Federal Communications Commission (FCC) for nationwide broadcasting of satellite-based Digital Audio Radio Service (DARS).

Communication network **142** includes services from one or more mobile telephone switching offices and wireless networks. Communication network **142** connects wireless carrier system **140** to land network **144**. Communication network **142** is implemented as any suitable system or collection of systems for connecting wireless carrier system **140** to mobile vehicle **110** and land network **144**. In one example, wireless carrier system **140** includes a short message service, modeled after established protocols such as IS-637 SMS standards, IS-136 air interface standards for SMS, and GSM 03.40 and 09.02 standards. Similar to paging, an SMS communication could be broadcast to a number of regional recipients. In another example, the carrier system **140** uses services in accordance with other standards, such as, for example, IEEE 802.11 compliant wireless systems and Bluetooth compliant wireless systems.

Land network **144** is a public-switched telephone network (PSTN). In one embodiment, land network **144** is implemented as an Internet protocol (IP) network. In other embodiments, land network **144** is implemented as a wired network, an optical network, a fiber network, another wireless network, or any combination thereof. Land network **144** is connected to one or more landline telephones. Land network **144** connects communication network **142** to user computer **150**, web-hosting portal **160**, and call center **170**. Communication network **142** and land network **144** connects wireless carrier system **140** to web-hosting portal **160** and call center **170**.

Client, personal or user computer **150** includes a computer usable medium to execute Internet browser and Internet-access computer programs for sending and receiving data over land network **144** and optionally, wired or wireless communication networks **142** to web-hosting portal **160** and test vehicle **110**. Personal or user computer **150** sends vehicle software update requests or field service software update data to web-hosting portal through a web-page interface using communication standards such as hypertext transport protocol (HTTP), and transport-control protocol Internet protocol (TCP/IP). In one embodiment, the data includes directives to change certain programming and operational modes of electronic and mechanical systems within test vehicle **110**. In another embodiment, the data includes executable code to reprogram certain functions such as operational modes of electronic and mechanical systems within test vehicle **110**. In operation, a user, such as, for example, a vehicle designer or manufacturing engineer, utilizes user computer **150** to provide requests to perform vehicle software update requests or field service software update data to mobile vehicle **110** that is cached or stored in web-hosting portal **160**. In an embodiment, mobile vehicle data from client-side software is transmitted to server-side software of web-hosting portal **160**. In one embodiment, vehicle software update request data is stored at web-hosting portal **160**. In another embodiment, client computer **150** includes a database (not shown) for storing received field service software update data. In yet another embodiment, a private Local Area Network (LAN) is implemented for client computer **150** and Web hosting portal **160**, such that web hosting portal is operated as a Virtual Private Network (VPN).

Web-hosting portal **160** includes one or more data modems **162**, one or more web servers **164**, one or more databases **166**, and a network **168**. Web-hosting portal **160** is connected directly by wire to call center **170**, or connected by phone lines to land network **144**, which is connected to call center **170**. Web-hosting portal **160** is connected to land network **144** by one or more data modems **162**. Land network **144** sends digital data to and from modem **162**; data that is subsequently transferred to web server **164**. In one implementation, modem **162** resides inside web server **164**. Land network **144** transmits data communications between web-hosting portal **160** and call center **170**.

Web server **164** receives various data, requests or instructions from user computer **150** via land network **144**. In alternative embodiments, user computer **150** includes a wireless modem to send data to web-hosting portal **160** through a wireless communication network **142** and a land network **144**. Data is received by modem **162** and sent to one or more web servers **164**. In one embodiment, web server **164** is implemented as any suitable hardware and software capable of providing web services to transmit and receive data from user computer **150** to telematics device **120** in test vehicle **110**. Web server **164** sends to or receives data transmissions from one or more databases **166** via network **168**. Web server **164** includes computer applications and files for managing mobile data.

In one embodiment, one or more web servers **164** are networked via network **168** to distribute field service software update data among its network components such as database **166**. In an example, database **166** is a part of or a separate computer from web server **164**. In one embodiment, web-server **164** sends data transmissions with mobile data to call center **170** via modem **162**, and through land network **144**.

Call center **170** is a location where many calls are received and serviced at the same time, or where many calls are sent at the same time. In one embodiment, the call center is a telematics call center, facilitating communications to and from telematics device **120** in test vehicle **110**. In an example, the call center is a voice call center, providing verbal communications between an advisor in the call center and a subscriber in a mobile vehicle. In another example, the call center contains each of these functions. In other embodiments, call center **170** and web-hosting portal **160** are located in the same or different facilities.

Call center **170** contains one or more voice and data switches **172**, one or more communication services managers **174**, one or more communication services databases **176**, one or more communication services advisors **178**, and one or more networks **180**.

Switch **172** of call center **170** connects to land network **144**. Switch **172** transmits voice or data transmissions from call center **170**, and receives voice or data transmissions from telematics device **120** in mobile vehicle **110** through wireless carrier system **140,** wireless access point node **136** or both, communication network **142**, and land network **144**. Switch **172** receives data transmissions from, and sends data transmissions to, one or more web-hosting portals **160**. Switch **172** receives data transmissions from, or sends data transmissions to, one or more communication services managers **174** via one or more networks **180**.

Communication services manager **174** is any suitable hardware and software capable of providing communication services to telematics device **120** in mobile vehicle **110**. Communication services manager **174** sends to or receives data transmissions from one or more communication services databases **176** via network **180**. Communication services manager **174** sends to or receives data transmissions from one or more communication services advisors **178** via network **180**. Communication services database **176** sends to

or receives data transmissions from communication services advisor **178** via network **180**. Communication services advisor **178** receives from or sends to switch **172** voice or data transmissions.

Communication services manager **174** facilitates one or more services, such as, but not limited to, enrollment services, navigation assistance, directory assistance, roadside assistance, business or residential assistance, information services assistance, emergency assistance, and communications assistance and vehicle software update management services. Communication services manager **174** receives service requests for a vehicle software update and field service software update data from a user via user computer **150**, web-hosting portal **160**, and land network **144**. Communication services manager **174** transmits and receives operational status, instructions and other types of vehicle data to telematics device **120** in mobile vehicle **110** through wireless carrier system **140**, communication network **142**, land network **144**, wireless access point node **136** voice and data switch **172**, and network **180**. Communication services manager **174** stores or retrieves field service software update data from communication services database **176**. Communication services manager **174** provides requested information to communication services advisor **178**.

In one embodiment, communication services advisor **178** is a real advisor. In another embodiment, communication services advisor **178** is implemented as a virtual advisor. In an example, a real advisor is a human being at service provider service center in verbal communication with service subscriber in mobile vehicle **110** via telematics device **120**. In another example, a virtual advisor is implemented as a synthesized voice interface responding to requests from telematics device **120** in mobile vehicle **110**. In another embodiment, communication services advisor **178** is embodied in software executing on a computing system, and provided automated field service functions, such as managing field service software update data.

Communication services advisor **178** provides services to telematics device **120** in mobile vehicle **110**. Services provided by communication services advisor **178** include enrollment services, navigation assistance, real-time traffic advisories, directory assistance, roadside assistance, business or residential assistance, information services assistance, emergency assistance, and communications assistance. Communication services advisor **178** communicates with telematics device **120** in mobile vehicle **110** through wireless carrier system **140**, communication network **142**, and land network **144** using voice transmissions, or through communication services manager **174** and switch **172** using data transmissions. Switch **172** selects between voice transmissions and data transmissions.

Mobile vehicle **110** initiates service requests to call center **170** by sending a voice or digital-signal command to telematics device **120** which in turn, sends an instructional signal or a voice call through wireless modem **124**, wireless carrier system **140**, communication network **142**, and land network **144** to call center **170**. In another embodiment, the service request is for a vehicle data upload (VDU) that initiates a data transfer between test vehicle **110** and service center **170** or web hosting portal **160**. In another embodiment, the mobile vehicle **110** receives a request from call center **170** to send various vehicle data from mobile vehicle **110** through telematics device **120** through wireless modem **124**, wireless access point node **136**, wireless carrier system **140**, communication network **142**, and land network **144** to call center **170**. In one embodiment, one or more triggers stored in the telematics device **120** cause the test vehicle to initiate a service request. The trigger is, for example, a number of ignition cycles, a specific time and date, an expired time, a number of kilometers, a request for a vehicle software update and the like.

FIG. 2 is a block diagram of an exemplary telematics based programming gateway in accordance with an embodiment of the present invention. FIG. 2 shows a telematics based programming gateway system **200** for providing field service software updates to a mobile vehicle. In one embodiment, the components of telematics based programming gateway system **200** are operational within an illustrative operating environment as described in FIG. 1.

In FIG. 2, the programming gateway system **200** includes a telematics service center **270**, and a mobile vehicle **210** having a telematics device **220** that is coupled to one or more vehicle system modules **290** via a communication bridge **212**. The telematics device **220** is shown including a database **228** that contains programs **231**, parameters **232**, update data **233** and event triggers **234**. The vehicle system module **290** is shown including a program **291** and update data **292**. The service center **270** is shown including a database **276** containing update data **273**, programs **272**, and event triggers **271**. The telematics service center is shown in communication with the telematics device **220** in vehicle **210**. In one embodiment, communications bus **212** coupling telematics device **220** to vehicle system modules **290** is a direct connection between the connected devices. In another embodiment, communications bus **212** is a vehicle communication bus **112** as described in FIG. 1.

Mobile vehicle **210** is any type of vehicle including a passenger vehicle, bus, truck and the like, that includes integrated vehicle system modules and a telematics device. In one embodiment, vehicle **210** and various systems of vehicle **210** are uniquely identifiable via an assigned identification code such as, for example, a vehicle identification number (VIN) or a device identification code of a vehicle system module **290** or telematics device **220**.

Telematics device **220** is any telematics device enabled for operation with a telematics service provider such as telematics device **120** as described with reference to FIG. 1. In one embodiment, telematics device **220** is coupled to vehicle communication bus **212** for communicating data between vehicle system modules **290** and the telematics device **220**. Telematics device **220** includes volatile and non-volatile memory components for storing data and programs. In one embodiment, memory components in telematics device **220** contain database **228**. In an embodiment, database **228** includes one or more programs **231** for managing software update processes, such as, for example, an update program module, and other programs **231** for detecting software update requests and the like. An update program module applies any field service update data **233** received to the telematics device **220** to update a vehicle system's software or operational parameters **232**. In still another embodiment, the telematics device **220** acts as a data cache for update data **233**, caching any received update data that is provided to a vehicle system module **290** for the telematics device.

Vehicle system module **290** (VSM, vehicle system, module) is any vehicle system control module having software and hardware components for operating, controlling or monitoring one or more vehicle systems. In one embodiment, vehicle system module **290** is a vehicle system controller such as, for example, a power train control module (PCM). In another embodiment, vehicle system module **290** contains one or more processors, one or more memory devices and one or more connection ports for communicating data to and from the VSM **290**. In an embodiment, VSM **290** is coupled to a vehicle communication bus **212**, and therefore to any other device that is also coupled to vehicle communication bus **212**. In another embodiment, VSM **290** is connected directly to telematics device **220**. In an embodiment, VSM **290** includes stored in memory, one or more programs **291** and update data **292**. In one embodiment, program **291** includes for managing software update processes, such as, for example, an update

program module. An update program module applies any field service update data **292** received to the VSM **290** from the telematics device **220** to update software or operational parameters of VSM **292**.

Telematics service center **270** is any service center providing telematics services such as service center **170** described with reference to FIG. 1. In one embodiment, service center **270** includes hardware and software for managing a field service software update database **276**. In another embodiment, service center **270** is configured to access a database that is in another location but coupled to service center **270** such as, for example, database **166** in web server **160** as described in FIG. 1. In an embodiment, database **276** contains records of vehicle system module updates. In an embodiment, database **276** includes one or more programs for managing vehicle update data, for managing software update processes for various vehicle systems, for responding to vehicle software update requests, and for detecting a field service software update trigger event. In another embodiment, database **276** is a relational database that includes information such as, for example, vehicle makes and models, vehicle system modules for the makes and models, individual vehicle identification numbers (VIN) and other vehicle identifiers, vehicle system software updates including vehicle system parameters and executable code, and trigger event data specifying conditions for field service software updates. The trigger is, for example, a number of ignition cycles, a specific time and date, an expired time, a number of kilometers, a request for a vehicle software update and the like.

In operation, service center **270** manages the compilation and delivery of VSM **290** field service software update data through a telematics service provider network such as the operating environment described in FIG. 1. In an embodiment, service center **270** is enabled to concatenate, and otherwise manage, software update data for vehicle **210** provided from multiple sources. In operation, service center **270** receives software and parameter upgrade data and associates the data with vehicle **210** in database **276**. A trigger event such as,

for example, the expiration of a periodic time interval or a request or a software update from a maintenance team or from vehicle **210** initiates an in-field software update for a VSM **290** of vehicle **210**. Software update data is provided to service center **270** from one or more client sources, such as, for example, an engineering center. In an embodiment, field service software update data is provided from the service center **270** to the telematics device **220** of mobile vehicle **210** based on a vehicle software update request. In one embodiment, the vehicle software update request is from a vehicle telematics device **220**. In another embodiment, the vehicle software update request is from a service center **270**.

In an embodiment, service center database **276** contains a relational database that includes identifiers for makes and model of vehicles and the vehicle system modules associated with the vehicle types. In one embodiment, the database **276** includes a list of specific vehicle identifiers, such as vehicle identification numbers, that catalogues specific vehicles in operation in the field. In another embodiment, the list of identified vehicles includes records of any field services that have been performed on each vehicle of the list. Therefore, a record of field services of any particular vehicle is maintained by the database. In yet another embodiment, various records applicable to field service software update data are distributed among several interconnected databases that are operably coupled to one another. In yet another embodiment, field service update data such as that stored in database **276** and database **228** is programs and other executable routines, vehicle system operating parameters, various event triggers such update event triggers, and software module lists.

FIG. 3 is a process flow diagram of a method for providing field service software updates to a mobile vehicle having a telematics device. In one embodiment, method **300** is implemented with components of the exemplary systems described with reference to FIGS. 1 and 2. In another embodiment, one or more steps of method **300** are embodied in a computer readable medium containing computer readable code. In yet another embodiment, computer readable code Method **300** begins in step **310**. In step **310**, a vehicle field service software update is initiated. In one embodiment, the field service software update occurs at any time that a mobile vehicle **210** is operational within a telematics based programming gateway system **200** for providing field service software updates to a mobile vehicle.

In an embodiment, initiating a field service software update for a vehicle comprises identifying a vehicle for updating, associating field service software update data with at least one vehicle system of the identified vehicle, and providing the field service software update data to a telematics service center for delivery to the identified vehicle responsive to a vehicle software update request for the identified vehicle. In one embodiment, the steps of identifying a vehicle for updating and associating field service software update data with at least one vehicle system of the identified vehicle occur at a different time than the step of providing the field service software update data to a telematics service center.

In one embodiment, the vehicle telematics device provides a vehicle software update request responsive to detecting a field service software update trigger event. In another embodiment, the telematics service center provides a vehicle software update request responsive to detecting a field service software update trigger event. In yet another embodiment, a service center compiles software update data for one or more vehicle systems in a relational database that is accessed to provide field service software update data to specific makes and models of vehicles. In one embodiment, a database at a service center contains a record for each of a plurality of mobile vehicles in operation in the field

by identifying the vehicle in the record with a unique identification code such as a vehicle identification number. In another embodiment, a vehicle system of a specific vehicle is identified in a vehicle record with a unique device identification code such as is known in the art. In still another embodiment, a record of field service software updates provided to a specific vehicle is accessed and updated each time that a field service software update is initiated for an identified vehicle.

In step **320**, field service software update data is sent to a vehicle telematics device from a telematics service center. The field service software update data is sent at any time after completion of step **310**. In one embodiment, one or more components of the exemplary system of FIG. 1 are employed to send the field service software update data to the vehicle telematics device, such as, for example, a service provider, a public-switched telephone network (PSTN), and a wireless carrier.

In step **330**, the field service software update data is received at the vehicle telematics device. The field service software update data is received at any time after it is sent in step **320**. One embodiment further comprises storing the field software update data at the vehicle telematics device responsive to receiving the update data. In still another embodiment, storing the field software update data includes caching the data in temporary storage or memory devices. In still another embodiment, field software update data is parsed for different content, such as, for example, executable routines, event triggers, device and system identification lists, and systems parameters, and each data type is stored in a memory location based on the data type.

In step **340**, the field service software update data is provided to at least one vehicle system from the vehicle telematics device. In an embodiment, the at least one vehicle system is updated based on the field service software update data. In another embodiment, providing the field service software update data to at least one vehicle system from the vehicle telematics device comprises detecting a vehicle system update trigger event at the telematics device, accessing an update program module stored at the vehicle telematics device responsive to the detecting, and invoking the update program module wherein the update program module applies the received field service software update data to update the at least one vehicle system. In this embodiment, the telematics device operates as a control unit for updating or reprogramming a vehicle system in response to an update trigger event. Again, in this embodiment, one or more update program modules are resident in memory in the telematics device to provide the update function to one or more vehicle system modules.

In another embodiment, providing the field service software update data to at least one vehicle system from the vehicle telematics device comprises detecting vehicle system update trigger event at the telematics device, accessing the received field service software update data, and applying the received field service update data to the at least one vehicle system to update the at least one vehicle system. In yet another embodiment, the at least one vehicle system includes executable code for performing the updating. In still another embodiment, executable code for performing the updating is included with the received field service update data. In an embodiment, the telematics device operates as a field service software data router system that receives and caches the data for application to one or more vehicle systems as the data is received, or at a later time. In one embodiment, an update event trigger causes a telematics device to request a vehicle software update from a service provider, which results in the telematics device receiving field service software update data that is applied to a vehicle system.

FIG. 4 is a process flow diagram of a method for providing field service software updates to a mobile vehicle having a telematics device (unit) in another embodiment of the present invention. In one embodiment, method **400** is implemented with components of the exemplary systems described with reference to FIGS. 1 and 2. In another embodiment, one or more steps of method **400** are embodied in a computer readable medium containing computer readable code. Method **400** begins in step **410**. In step **410**, data including a module list and routines and parameters associated with the module list is delivered to a telematics device. In one embodiment, the module list is a list of vehicle system modules in the vehicle receiving the list. In an embodiment, the data is delivered to a telematics device from a service center in response to a vehicle software update request for an identified vehicle. In another embodiment, event triggers are received and stored at the telematics device that when detected, initiate software maintenance functions, such as reprogramming or installing new parameters to a module.

In step **420**, a determination is made if an event trigger is detected to reprogram or install new parameters to a module. When the determination in step **420** is false, or no, method **400** returns to step **410**. When the determination in step **420** is true or yes, method **400** continues to step **430**.

In step **430**, the telematics device retrieves the module identification associated with the module list and the event trigger. The module identification (ID) is any identifier such as, for example, an electronic serial number (ESN) or another identifier as is known in the art. The module ID correlates data and parameters that are associated with an update of the identified module.

In step **440**, the telematics device controls the reprogramming of the module data identified in step **430**. In one embodiment, method **400** returns to step **420** once step **440** is completed. In another embodiment, method **400** terminates once step **440** is completed.

It is anticipated that the invention will be embodied in other specific forms not described that do not depart from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive.